REMARKS

Applicant respectfully request reconsideration of the present application.

Claims 1-19 are pending, with claims 1, 14 and 18 being independent.

In the Official Action, claims 1-2, 4-16 and 18-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Dalal et al. (U.S. Patent No. 5,892,891, hereinafter Dalal), Morag et al. (U.S. Patent No. 5,343,311, hereinafter Morag) and Ishimoto (U.S. Patent Publication No. 2003/0226473); and claims 3 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Dalal, Morag, Ishimoto and Ebner (U.S. Patent No. 5,689,344).

Briefly recapitulating, claim 1 is directed to

> A method of rendering colours in a printing system using a set of N colorants, including, for each colour to be rendered, a selection of a subset of M colorants whereby M<N and for each colorant of said subset, a selection of a halftone screen among a plurality of available halftone screens and a coverage fraction, the method comprising steps:
>
> defining discrete colour points in at least a portion of a colour space;
>
> determining for the defined discrete colour points, different subsets of colorants and associated coverage fractions thereof, rendering each of said colour points, and calculating for each of said subsets an associated graininess value;
>
> determining lists of colorant subsets rendering the defined discrete colour points, said lists being consistent with respect to the attribution of a halftone screen to a colorant within a subset over said portion of the colour space; and
>
> selecting one of said lists of subsets of colorants on the basis of a total graininess calculated for said lists.

Claim 18 is directed to a computer program product computer-executable instructions for the method recited in claim 1. Claim 14 is directed to a printing system rendering colours by selecting subsets of M colorants rendering said colours among a set of colorants whereby M<N,

and halftone screens associated to said colorants in the subset, including means for performing the method recited in claim 1.

Dalal describes a device and method for printing a desired color as a combination of a set of colorants. Combinations of colorants comprising at least a first colorant, second colorant, and third colorant are defined as a main gamut, the main gamut substantially evenly surrounding an origin in device-independent color space. An extended gamut is defined as including colors printable with a fourth colorant combined with at least the first colorant ***but excluding the second colorant.*** A desired color in the main gamut is printed with the first colorant and second colorant, and a desired color in the extended gamut is printed with the first colorant and the fourth colorant ***but excluding the second colorant.***

In particular, Dalal describes that a particular color which is desired to be printed, which may originate, for example, in the RGB signals of a hard-copy scanner or which is apparent to a human user in the RGB signals from a CRT, is mapped to a device-independent color space such as L*a*b*. In the device independent color space, the desired color is determined to be either within the main gamut 100 or in the extended gamut 102. Dalal provides for the main gamut 100 and the extended gamut 102 ***being mutually exclusive within device-independent color space***, so that all colors within main gamut 100 are printed with the CMYK colorants, and all colors within the extended gamut 102 are printed with the MYKO colorants.[1]

[1] Dalal, column 5, line 47 – column 6, line 14.

Dalal further describes an alternative embodiment with up to three distinct extended gamuts, being provided by orange, green, and blue colorants respectively. Dalal notes that in such a case, the same principle of mutual exclusivity would exist.[2]

Dalal describes that the mutual exclusivity of the main gamut 100 and extended gamut 102 provides numerous practical advantages. First, if a hi-fi color printing system which had five available colorants such as CMYKO were used, there would have to be provided an arrangement of halftone screens on the print sheet that would accommodate five simultaneous halftone screens, one screen for each colorant. Under the system of Dalal, colors in the main gamut will be printed with a CMYK set of screens, while colors in the extended gamut 102 will be printed with the MYKO set of screens: ***in either case, only four halftone screens need to be accommodated in a pattern on the printing surface***, just as with basic four-color halftone printing. For printing colors in the extended gamut, the locations in the printing area which had been dedicated to the cyan screen for printing in the main gamut are simply substituted with a halftone screen for orange.[3]

However, contrary to the Official Action, Dalal does not disclose or suggest Applicant's claimed "selection of a halftone screen among a plurality of available halftone screens." Furthermore, contrary to the Official Action, Dalal does not disclose or suggest Applicant's claimed "said lists being consistent with respect to the attribution of a halftone screen to a colorant within a subset over said portion of the colour space."

As noted above, in Dalal, "***only four halftone screens need to be accommodated in a pattern on the printing surface***, just as with basic four-color halftone printing." In contrast, in

[2] Dalal, column 7, line 60 – column 8, line 9.
[3] Dalal, column 7, lines 18-35.

Applicant's invention, connection lists of subsets $\{k_{ij}^{n}\}$ allowed in that part of the colour space are established. According to a primary connecting rule, the same halftone screen is ***attributed*** to a colorant present in both subsets rendering two closest neighboring colour points.[4]

By way of a non-limiting example, in Applicant's Fig. 3, for each of the colours labelled from i=1 to i=8, one possible subset rendering a colour is shown. In each case, the shown subset is the first possible subset rendering each of the colours and therefore labelled by j=1. Colour point 4 has as closest neighbour points 2, 3, 5 and 6 in that part of the colour space, points 1 and 3 are closest neighbours of each other, points 5 and 7 as well and so on. Now it has to be checked whether or not the subsets of that list are consistent with each other. To accomplish this, the following primary rule has to be fulfilled: the same halftone screen is attributed to a colorant present in both subsets rendering two closest neighboring colour points. It is seen in Fig. 3 that the subset $K_{4,1}{}^{1}G_{4,1}{}^{2}B_{4,1}{}^{3}Y_{4,1}{}^{4}$ for colour points 4 (i=4) is consistent with the subset $R_{2,1}{}^{1}G_{2,1}{}^{2}B_{2,1}{}^{3}Y_{2,1}{}^{4}$ for colour point 2 (i=2), because second, third and fourth halftone screens are in both subsets respectively attributed to the same colorants G, B, Y. The subset $K_{4,1}{}^{1}G_{4,1}{}^{2}B_{4,1}{}^{3}Y_{4,1}{}^{4}$ is also consistent with subsets $K_{3,1}{}^{1}G_{3,1}{}^{2}B_{3,1}{}^{3}M_{3,1}{}^{4}$ (colour point 3), $K_{5,1}{}^{1}G_{5,1}{}^{2}B_{5,1}{}^{3}Y_{5,1}{}^{4}$ (colour point 5, happening to be the same subset as $K_{4,1}{}^{1}G_{4,1}{}^{2}B_{4,1}{}^{3}Y_{4,1}{}^{4}$, and $K_{6,1}{}^{1}G_{6,1}{}^{2}M_{6,1}{}^{3}Y_{6,1}{}^{4}$ (point 6), as can be easily verified. Furthermore, subset $\{k_{1,1}^{n}\}$ is consistent with subsets $\{k_{2,1}^{n}\}$ and $\{k_{3,1}^{n}\}$. Further, subset $\{k_{5,1}^{n}\}$ is consistent with subset $\{k_{7,1}^{n}\}$ as well. However, it appears that subset $\{k_{6,1}^{n}\}$ is not consistent with subset $\{k_{7,1}^{n}\}$ because colorant M gets the third halftone screen in subset $\{k_{6,1}^{n}\}$ while it gets the fourth halftone screen in subset $\{k_{7,1}^{n}\}$. There is a conflict between both these sets, meaning that they are not consistent with

[4] Specification, paragraph 044.

each other. A possible solution is to ***search for another subset*** $\{k_{6,j}^{n}\}$ that would be consistent with its closest neighbors.[5]

With the above procedure, there is a "selection of a halftone screen among a plurality of available halftone screens." Furthermore, this procedure results in "said lists being consistent with respect to the attribution of a halftone screen to a colorant within a subset over said portion of the colour space." Nothing in Dalal selects a halftone screen among a plurality of available halftone screens because the halftone values are fixed. Furthermore, nothing in Dalal relates to lists being consistent with respect to the attribution of a halftone screen to a colorant within a subset over said portion of the colour space.

As acknowledged by the Official Action, Dalal does not disclose or suggest Applicant's claimed coverage fraction. Applicant first submits that the Official Action misquotes Applicant's independent claims. That is, the question is not whether Dalal discloses Applicant's claimed coverage fraction. The question is whether Dalal discloses "a selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***" That is, does Dalal disclose or suggest a selection of a halftone screen based a coverage fraction. Clearly, Dalal does not.

To cure the lack of any reference to coverage fraction in Dalal, the Official Action applies Morag. Morag describes a method of handling an image comprised of a finite number of pixels containing color information. The method includes taking the color information of each pixel, such information represented by the coordinates of a point in a color space, and assigning to each pixel an index to the coordinates of a representative color point in a volume element

[5] Specification, paragraph 045.

defined in the color space where the volume element also contains the pixel's color point. Each unique color point in the color space of the invention represents a unique color value (having typically three coordinate values, such as L*, a* and b*) in the color space.

In particular, Morag describes that, because a color space is comprised of a continuum of colors rather than a set of discrete colors (as might be inferred from the term "color points"), there are color variations which occur between each discrete color point represented by 8-bit integers for L*, a*, and b*. Thus, Morag notes there is already an inherent quantization of the color space and that replacing 64 color points in a particular cube by the color coordinates of a centroid of that cube is further quantization of the color space. Morag discloses an assumption that the initial quantization of using 8-bit integers for the color space coordinates involves truncation. That is, when counting from zero and moving along either the a*-axis, b*-axis, or L*-axis (or, as shown in FIG. 4 of Morag, for the two-dimensional L*-a* case), any color between a color point of 0 and a color point of 1 gets assigned a color point value of 0. Similarly, any color between a color point of 1 and a color point of 2 gets assigned a color point value of 1, any color between a color point of 2 and a color point of 3 gets assigned a color point value of 2, and any color between a color point of 3 and a color point of 4 gets assigned a color point value of 3. In other words, color points 0 through 3 cover the color range of 0 through 3.999999.

However, contrary to the Official Action, the quantization with a centroid by Morag does not relate to a coverage fraction. Furthermore, like Dalal, Morag does not disclose or suggest "a selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***"

Referring to Applicant's Fig. 4, after the previous step has been finalized, a secondary rule is applied to colorants which are present in a subset rendering colour points and not in a subset rendering a neighboring colour point. Since the number of halftone screens available is limited, a common halftone screen has to be shared by different colorants. For every subset, a halftone screen has to be associated to each colorant. Here, halftone screens taken over from one colorant to a different colorant need to have a limited area coverage fraction. In order to minimize registration errors that become too visible, a secondary rule is applied to decide whether or not two subsets rendering two neighboring colours in that part of the colour space are connected: if the coverage fraction of one of the colorants of subset rendering a colour is less than a chosen threshold value x, then the halftone screen of this colorant may be taken over by a different colorant in a subset rendering a neighboring colour, at the condition that it also has a coverage fraction smaller than x. If it is impossible to connect two subsets rendering two neighbouring colours in that part of the colour space according to the secondary rule, this connection is forbidden.[6]

Again in a non-limiting example, Applicant's Fig. 3 shows that the subset $K_{4,1}{}^1G_{4,1}{}^2B_{4,1}{}^3Y_{4,1}{}^4$ for point 4 is consistent with the subset $R_{2,1}{}^1G_{2,1}{}^2B_{2,1}{}^3Y_{2,1}{}^4$ for point 2 according to the primary rule. In this example, a possible threshold value for the coverage fraction is x=16%. In this case, if the coverage fraction for K in the subset rendering point 4 is 8% and the coverage fraction for R in the subset rendering point 2 is 5%, then the connection is allowed according to the secondary connection rule, because both coverage fractions are smaller than the threshold value x. However, if the coverage fraction for R in the subset rendering point

[6] Specification, paragraph 046.

2 is 26% the connection is forbidden according to the secondary rule, because the coverage fraction is larger than the threshold value.[7]

In order to minimize the possibility that registration errors become too visible, Applicant's claimed invention considers coverage fractions to decide whether or not two subsets rendering two neighbouring colours in that part of the colour space are connected. That is, if the coverage fraction of one of the colorants of subset rendering a colour ***is less than a chosen threshold value x***, then the halftone screen of this colorant may be taken over by a different colorant in a subset rendering a neighbouring colour, at the condition that it also has a coverage fraction smaller than x. If it is impossible to connect two subsets rendering two neighbouring colours in that part of the colour space according to the secondary rule, this connection is forbidden. Again by way of a non-limiting example, as seen in Applicant's Fig. 3, the subset $K_{4,1}{}^{1}G_{4,1}{}^{2}B_{4,1}{}^{3}Y_{4,1}{}^{4}$ for point 4 is consistent with the subset $R_{2,1}{}^{1}G_{2,1}{}^{2}B_{2,1}{}^{3}Y_{2,1}{}^{4}$ for point 2 according to the previously described primary rule pertaining to halftones. However, in this non-limiting example, a possible threshold value for the coverage fraction is x=16%. In this case, if the coverage fraction for K in the subset rendering point 4 is 8% and the coverage fraction for R in the subset rendering point 2 is 5%, then the connection is allowed according to the secondary connection rule, because both coverage fractions are smaller than the threshold value x. However, if the coverage fraction for R in the subset rendering point 2 is 26% the connection is forbidden according to the secondary rule, because the coverage fraction is larger than the

[7] Specification, paragraph 047.

threshold value.[8] Thus, there is "a selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***"

If the present rejection is not withdrawn, Applicant requests a detailed explanation for why the quantization with a centroid by Morag is equivalent or even relevant to Applicant's claimed "selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***"

Morag goes on to describe a hashing algorithm used to address entries in an image independent index table. Here, when a pixel's RGB color information is translated into three bytes of the CIE-LAB color space, the 6 high order bits (six most significant bits) of each byte are used. Morag determines whether these three 6-bit members form one of the entries in the image independent index table. The hashing scheme does this efficiently as follows: Three tables (LTable, aTable, and bTable) are formed by methods well known in the art. These tables are used as look-up-tables. If an entry in particular location of the image independent index table is equivalent, then this means that the proper entry was found (called a "hit" in the art). If there is no hit, another attempt is needed and this is done by adding a "jump value" to the current location searched to form a new location to try. This addition is performed modulo the length of the image independent index table to ensure that the result is a valid table location. In the scheme of the preferred embodiment of the present invention, a jump value of 211 is used for the table of length 50,001. This jump value was chosen for the preferred embodiment because it was found that use of this jump value with the other chosen parameters guarantees a maximum of three tries

[8] Specification, paragraph 048.

before a hit is obtained. In the preferred embodiment of the present invention, using images of natural scenes, an average of 1.055689 tries is required to obtain a hit.

However, like the centroid of Morag, the hashing table of Morag is also not relevant to Applicant's claimed "selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***" If the present rejection is not withdrawn, Applicant requests a detailed explanation for why the hashing table of Morag is equivalent or even relevant to Applicant's claimed "selection of a halftone screen among a plurality of available halftone screens ***and a coverage fraction.***"

Furthermore, assuming *arguendo* that either the centroid or the hashing table of Morag is somehow related to Applicant's claimed coverage fraction, Morag does not select a halftone screen among a plurality of available halftone screens ***and a coverage fraction.*** That is, there is no mention of halftones, or selections of halftones within Morag. Furthermore, it is not clear how any of the algorithms of Dalal would be modified to account for the centroid values or hash table values of Morag to result in a selection of a halftone screen among a plurality of available halftone screens. Thus, Applicant submits that the proposed combination is based upon an improper hindsight reconstruction of Applicant's invention.

As acknowledged by the Official Action, Dalal and Morag each fail to disclose or suggest calculating for each of said subsets an associated graininess value. To cure this deficiency, the Official Action applies Ishimoto. However, the Official Action provides no citation for Applicant's claimed "selecting one of said lists of subsets of colorants on the basis of a total graininess calculated for said lists." That is while Ishimoto describes evaluating graininess, the

evaluation value calculated by Ishimoto is not used to select one of plural lists of subsets of colorants on the basis of a total graininess calculated for said lists.

Indeed, Ishimoto only describes ***an ink set*** for which color differences of a recorded image due to differences in light source can be made to be slight, and the color reproduction range in dark parts of an image can be broadened, while maintaining high image quality with no worsening of the graininess in the dark parts. The evaluation of graininess described in Ishimoto is only used to evaluate various ink sets, and is not used to select anything. Indeed, there is no automatic selection of anything in Ishimoto based on any criteria, let alone based on graininess.

Furthermore, it is not clear how any of the algorithms of Dalal would be modified to accommodate a graininess evaluation provided by Ishimoto. Again, Applicant submits that the present rejection is based upon an improper hindsight reconstruction of Applicant's claimed invention.

Applicant has considered Ebner and submit Ebner does not cure the above noted deficiencies. As none of the cited art, individually or in combination, discloses or suggests at least the above-noted features of independent claims 1, 14 and 18, Applicant submits the inventions defined by claims 1, 14 and 18, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.[9] Thus, for a first reason, Applicant requests withdrawal of the current rejections.

Furthermore, regarding the improper hindsight reconstruction of Applicant's invention, In <u>KSR v. Teleflex</u> (127 S. Ct. 1727, 1740 (2007)), the Court noted that

[9] MPEP § 2142 "…the prior art reference (or references when combined) must teach or suggest **all** the claim limitations.

> "[u]nder the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." The Court also noted that "a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103."

However, the Court went on to note that

> "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some ***rational*** underpinning to support the legal conclusion of obviousness."

Here, however, the Official Action fails to provide a rational reason, due to either a misunderstanding of the invention/references or hindsight reasoning, for replacing or augmenting mutually exclusive gamuts of Dalal with the centroid/hashing calculations of Morag and with the graininess evaluation of Ishimoto. That is, there is no rational reason to replace or augment the mutually exclusive gamuts of Dalal with the centroid/hashing calculations of Morag and with the graininess evaluation of Ishimoto. Thus, for a second reason, Applicant requests that the present rejections under 35 U.S.C. § 103(a) be withdrawn.

Conclusion

In view of the above remarks, it is believed that claims are allowable.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco Reg. No. 52,041 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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